REMARKS

Claims 1-16 are all the claims presently pending in the application. Claims 1 and 8 have been amended to more particularly define the invention. Claims 10-16 have been added to assure Applicant the degree of protection to which his invention entitles him.

It is noted that the claim amendments herein or later are not made to distinguish the invention over the prior art or narrow the claims or for any statutory requirements of patentability. Further, Applicant specifically states that no amendment to any claim herein or later should be construed as a disclaimer of any interest in or right to an equivalent of any element or feature of the amended claim.

With respect to the prior art rejections, claims 1, 4-5 and 7 stand rejected under 35 U.S.C. §102(e) as being anticipated by Slater et al. (U.S. Patent No. 6,791,119). Claims 2-3 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Slater et al. in view of Lin et al. (U.S. Patent No. 6,614,058). Claims 6 and 8-9 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Slater et al. in view of Lowery et al. (U.S. Patent No. 6,351,069).

These rejections are respectfully traversed in the following discussion.

I. THE CLAIMED INVENTION

An exemplary aspect of the invention, as recited in claim 1, is directed to a light emitting apparatus, including a semiconductor light emitting element that radiates light from a light emission surface provided on a side opposite to an electrode forming surface of the light emitting element, lead frames that are electrically connected to electrodes formed on the electrode forming surface through wires, a transparent structure that is optically connected

with the light emission surface and has a light distribution characteristic based on its three-dimensional shape, the transparent structure being mounted on a substrate positioned on a side opposite the light emitting element, and light transmitting resin that seals the semiconductor light emitting element and the transparent structure..

Another aspect of the present invention, as recited in claim 8, provides a light emitting apparatus including a semiconductor light emitting element that radiates light from a light emission surface provided on a substrate opposite an electrode forming surface, lead frames that are electrically connected to electrodes formed on the electrode forming surface through wires, a transparent structure that is optically connected with the light emission surface and has a light distribution characteristic based on its three-dimensional shape, and light transmitting resin that seals the semiconductor light emitting element and the transparent structure, the light transmitting resin including a phosphor to wavelength-convert light emitted from the semiconductor light emitting element.

A further aspect of the invention, as recited in claim 16, is directed to a light emitting apparatus, including a semiconductor light emitting element that radiates light from a light emission surface provided on an opposite side to an electrode forming surface, lead frames that are electrically connected to electrodes formed on the electrode forming surface through wires, a transparent structure that is optically connected with the light emission surface and has a light distribution characteristic based on its three-dimensional shape, and light transmitting resin that seals the semiconductor light emitting element and the transparent structure, wherein the transparent structure has a length in the horizontal direction greater than that of the semiconductor light emitting element.

A conventional light emitting apparatus includes an LED chip housed in a concave portion of a package, a first and second coating of light transmitting resin embedding in the concave portion and bonding wires connecting the LED chip to external electrodes. The second resin coating may contain a phosphor for wavelength-converting light passing therethrough. (See Application at page 1, lines 20-29 and Figure 1)

However, the phosphor in the second layer and electrodes on the LED chip can block the radiation of light, thus lowering the light extraction efficiency of the apparatus and resulting in insufficient brightness. (See Application at Figure 1 and page 3, lines 18-24)

Another conventional light emitting apparatus includes an LED chip formed on a transparent substrate housed in a pair a lead frames including reflection horns which secure the LED chip and a wavelength conversion element disposed on the substrate. The wavelength conversion element includes a wavelength conversion layer containing wavelength conversion material and a resin binding agent formed on a base film. The electrodes of the LED chip are electrically connected to the bottom surface of the reflection horns. (See Application at Figure 2, page 2, lines 13-29 and page 3, lines 1-8)

However, the manufacture of such apparatuses is complicated and expensive. (See Application at page 3, lines 9-15 and lines 25-29, and page 4, lines 1-2)

The claimed invention, on the other hand, includes a semiconductor light emitting element that radiates light from a light emission surface provided on a substrate opposite an electrode forming surface and a transparent structure that is optically connected with the light emission surface and has a light distribution characteristic based on its three-dimensional

shape. These features, amongst others, provide a light emitting apparatus which has high light extraction efficiency while utilizing the easy to manufacture wire-bonding structure.

II. THE PRIOR ART REFERENCES

A. The Slater et al. Reference

The Examiner alleges that the invention of claims 1, 4-5 and 7 are anticipated by Slater et al. However, Applicant respectfully submits that the reference does not teach or suggest each and every element of the claimed invention.

Slater et al. discloses a light emitting diode including a substrate having first and second opposing faces and that is transparent to optical radiation in a predetermined wavelength range and that is patterned to define, in cross-section, a plurality of pedestals that extend into the substrate from the first face toward the second face. (Slater et al. at Abstract)

However, Slater et al. does not disclose or suggest a semiconductor light emitting element that radiates light from a light emission surface provided on a substrate opposite an electrode forming surface and a transparent structure that is optically connected with the light emission surface and has a light distribution characteristic based on its three-dimensional shape, as recited in claims 1, 4-5 and 7. (Emphasis added)

Rather, Slater et al. discloses a light emitting diode 100 including a silicon carbide substrate 110 that is transparent to optical radiation in a predetermined wavelength. The diode 100 is configured to emit light into the substrate 110 upon application of a voltage. (See Slater et al. at Figure 1 and column 7, lines 20-31) In Slater et al., light generated by the diode is emitted into the substrate 110 for extraction. Geometric modifications of the

substrate 110 can provide a "means for extracting, from the substrate, at least some of the light, and allow enhanced extraction efficiency from interior regions of the substrate." (Slater et al. at column 12, lines 30-34)

The present invention, on the other hand, provides a transparent structure 5 that is bonded to the LED chip 3. Light from the LED chip 3 is mainly emitted from the substrate 3A on the opposite side of the electrode forming surface. The transparent structure 5 is bonded to the substrate 3A through an adhesive layer 4. (See Application at Figure 4, page 7, lines 12-19) As such, light emitted from the multiple layers 3F passes through the substrate 3A and enters the transparent structure 5. The transparent structure 5 reflects part of the entered light inside it, then discharges the light from its side surfaces and upper face. (See Application at page 9, lines 21-29)

In the present invention, since light is radiated through the transparent structure 5, the light emission density lowers and a light distribution characteristic different from that of the LED chip 3 by itself can be obtained. Additionally, since the light emission area is enlarged due to the transparent structure 5, the light shield effect of caused by covering the LED with phosphor can be reduced and, thereby, the brightness can be enhanced. (See Application at page 10, lines 19-29)

Indeed, Slater et al. makes no reference or suggestion to the provision of a transparent structure connected to the substrate of the LED chip to discharge light emitted from the LED chip, as indicated in claims 1, 4-5 and 7. Rather, Slater et al. merely modifies the geometry of the substrate of the LED chip.

Therefore, Applicant submits that there are elements of the invention of claims 1, 4-5 and 7 that are not taught or suggest by Slater et al. Therefore, the Examiner is respectfully requested to withdraw this rejection.

B. The Lin et al. Reference

The Examiner alleges that Slater et al. would have been combined with Lin et al. to form the invention of claims 2 and 3. However, Applicant submits that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention.

Lin et al. discloses a light emitting semiconductor device with a surface-mounted and flip-chip package structure. (Lin et al. at Abstract)

Applicant respectfully submits that these references would not have been combined as alleged by the Examiner. Indeed, no person of ordinary skill in the art would have considered combining these disparate references, absent impermissible hindsight.

In fact, Applicant submits that the Examiner can point to no motivation or suggestion in the references to urge the combination as alleged by the Examiner. Indeed, contrary to the Examiner's allegations, none of these references teach or suggest their combination.

Therefore, Applicant respectfully submits that one of ordinary skill in the art would not have been so motivated to combine the references as alleged by the Examiner. Therefore, the Examiner has failed to make a prima facie case of obviousness.

Further, Lin et al. fails to make up for the deficiencies of Slater et al. described above, directed toward a transparent structure that is optically connected with the light emission

surface and has a light distribution characteristic based on its three-dimensional shape to provide a light emitting apparatus which has high light extraction and ease of manufacture.

The Examiner concedes that Slater et al. fails to disclose or suggest that "the transparent structure has a length in the horizontal direction greater than that of the semiconductor light emitting element," as recited in claim 2. Rather, the Examiner attempts to rely on Figure 5, column 5, lines 59-67, and column 3, lines 38-40 of Lin et al. to make up for the deficiencies of Slater et al.

However, this feature is not taught or suggested by Lin et al. In fact, nowhere do the cited figure or passages teach or suggest that the transparent structure has a length in the horizontal direction greater than that of the semiconductor light emitting element in order to enlarge the light emission area and enhance the brightness of the apparatus.

Rather, Lin et al. discloses that "the sidewall of the LED 402 can be on an incline 430." (Lin et al. at column 5, lines 59-60) Lin et al. further discloses that "the light emitted from the LED 402 can radiate outwardly by transmitting through the sapphire substrate 403." (Lin et al. at column 5, lines 63-67) Thus, Lin et al. merely discloses that the substrate 403 may have in inclined surface.

Indeed, Lin et al. makes no reference or suggestion to a transparent structure that is optically connected with the light emission surface on the substrate, and certainly not to the transparent structure having a length in the horizontal direction greater than that of the semiconductor light emitting element, as required in claim 2. Clearly, Lin et al. fails to make up for the deficiencies of Slater et al.

In light of the above, Applicant submits that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention. Therefore, the Examiner is respectfully requested to withdraw this rejection.

C. The Lowery et al. Reference

The Examiner alleges that Slater et al. would have been combined with Lowery et al. to form the invention of claims 6 and 8-9. However, Applicant submits that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention.

Lowery et al. discloses a light emitting device and a method of fabricating the device utilizing a supplementary fluorescent material that radiates secondary light in the red spectral region of the visible light spectrum to increase the red color component of the composite output light. (Lowery et al. at Abstract)

Applicant submits that the Examiner can point to no motivation or suggestion in the references to urge the combination as alleged by the Examiner. Indeed, contrary to the Examiner's allegations, none of these references teaches or suggests their combination.

Therefore, Applicant respectfully submits that one of ordinary skill in the art would not have been so motivated to combine the references as alleged by the Examiner. Therefore, the Examiner has failed to make a prima facie case of obviousness.

Further, Lowery et al. fails to make up for the deficiencies of Slater et al. described above, directed toward a transparent structure that is optically connected with the light

emission surface and has a light distribution characteristic to provide a light emitting apparatus which has high light extraction and ease of manufacture.

The Examiner concedes that Slater et al. fails to disclose or suggest that "one of the lead frames has a cup portion, and the transparent structure is fixed on the cup portion through adhesive resin," as recited in claim 6. Rather, the Examiner attempts to rely on Figure 3 of Lowery et al. to make up for the deficiencies of Slater et al.

However, these features are not taught or suggested by Lowery et al. In fact, nowhere do the cited figure or passages teach or suggest that the transparent structure is adhered to the cup portion of the lead frame.

Rather, Lowery et al. discloses that a "light emitting device is an LED that includes a die that emits primary light in response to an electrical signal," and that "the die is a Gallium Nitride (GaN) based die." (Lowery et al. at column 2, lines 50-52) Lowery et al. further discloses that it is "the Gallium Nitride (GaN) die 12 that is positioned on the reflector cup lead frame." (Lowery et al. at column 4, lines 61-63) Thus, Lowery et al. merely discloses that the Gallium Nitride (GaN) die 12 is attached to the lead frame.

Indeed, Lowery et al. makes no reference or suggestion to a transparent structure that is optically connected with the light emission surface on the substrate, and certainly not to the transparent structure being adhered to the cup portion of the lead frame, as required in claim 6. Clearly, Lowery et al. fails to make up for the deficiencies of Slater et al.

The Examiner further asserts that Slater et al. would be modified by Lowery et al. to teach "the light transmitting resin including a phosphor to wavelength-convert light emitted

from the semiconductor light emitting element," as recited in claim 8, and also that "the light transmitting resin contains two or more kinds of phosphors," as recited in claim 9.

However, as noted above, Lowery et al. makes no reference or suggestion to a transparent structure that is optically connected with the light emission surface on the substrate, as required in claims 8 and 9.

Thus, even assuming arguendo that Lowery et al. may disclose that the light transmitting resin may include one or more phosphors, as alleged by the Examiner, there is no teaching or suggestion in Lowery et al. of a transparent structure that is optically connected with the light emission surface on the substrate to provide a light emitting apparatus which has high light extraction and ease of manufacture, as in claims 6 and 8-9. Indeed, the cited reference does not even recognize the desirability or benefit of providing such a feature. Therefore, Lowery et al. clearly does not make up for the deficiencies of Slater et al.

In light of the above, Applicant submits that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention. Therefore, the Examiner is respectfully requested to withdraw this rejection.

III. CONCLUSION

In view of the foregoing, Applicant submits that claims 1-16, all the claims presently pending in the application, are patentably distinct over the prior art of record and are allowable, and that the application is in condition for allowance. Such action would be appreciated.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned attorney at the local telephone number listed below to discuss any other changes deemed necessary for allowance in a telephonic or personal interview.

To the extent necessary, Applicant petitions for an extension of time under 37 CFR §1.136. The Commissioner is authorized to charge any deficiency in fees, including extension of time fees, or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

Date: 4/25/05

J. Bradley Wright, Esq.
Registration No. 47,188

Sean M. McGinn, Esq.
Registration No. 34,386

McGinn & Gibb, PLLC
8321 Old Courthouse Road, Suite 200
Vienna, VA 22182-3817
(703) 761-4100
Customer No. 21254